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October 1990

THE MAC FLYER - For Greater Safety in MAC Air Operations

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THE MAC FLYER—For Greater Safety in MAC Air Operations

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IT'S THAT TIME OF THE YEAR AGAIN!

Yessiree, folks! Summer is gone, vacations are over, and the kids are back in school. The frost is on the pumpkin and it's once again time for the 1991 MAC Flight Safety Writing Contest.

Don't be afraid to take the plunge. We guarantee that once you enter, you'll be hooked. (Have you noticed the familiar names appearing year after year?)

Base your masterpiece on fact, fiction, or fantasy. Make it in prose, poetry, or both. Winners have done it *almost* every conceivable way. This is your chance to display your flair and style—*Take this chance before 31 March 1991.*

THE RULES

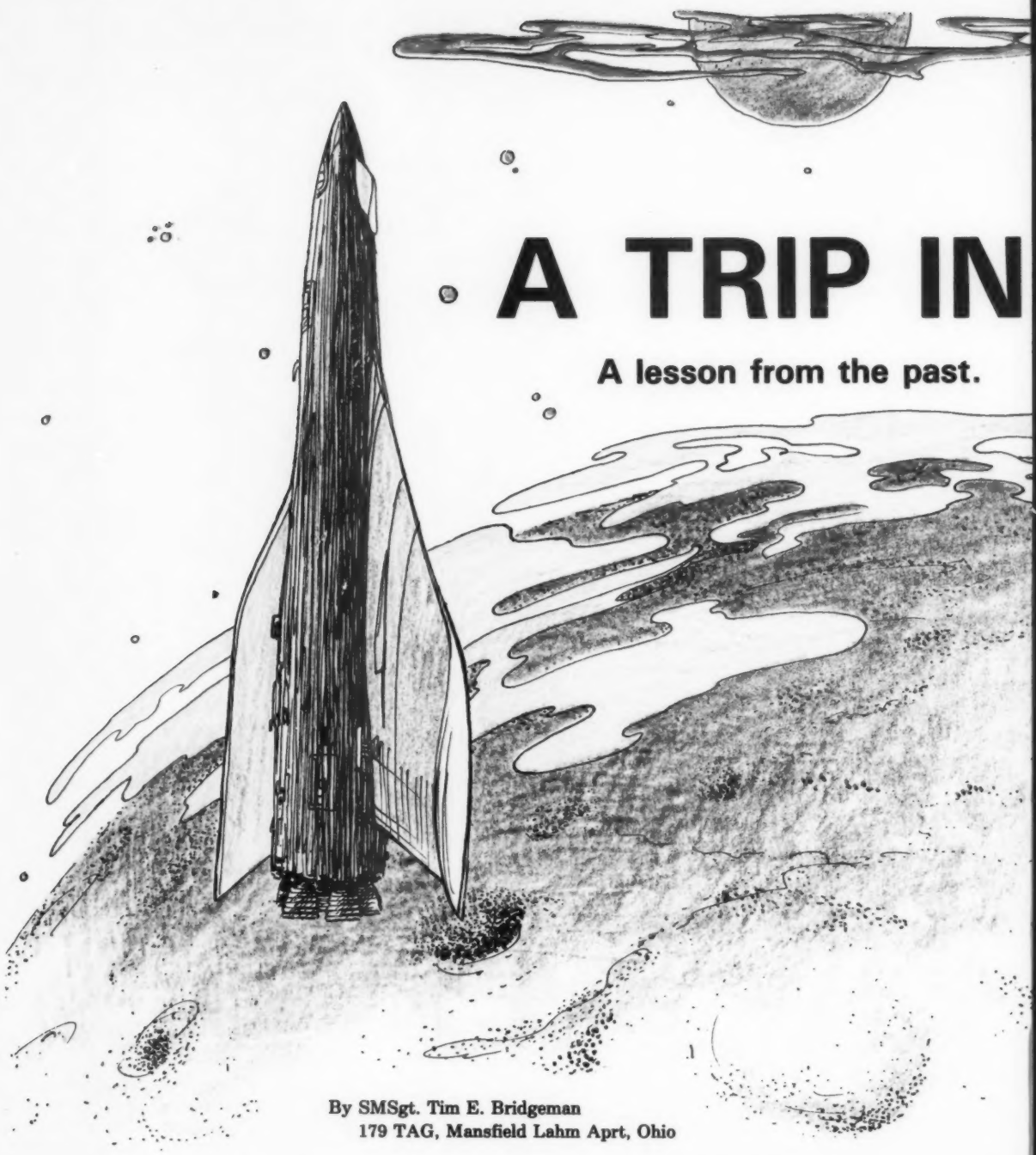
The 1991 MAC Flight Safety Writing Contest is conducted according to MACR 900-3 and these rules. Entries must be original, unpublished, contain an aviation safety/mishap prevention message, and be postmarked no later than 31 March 1991. Stories must be between approximately 1,000 and 3,000 words long (about 6 to 14 double-spaced types pages). Poetry should average 75 to 100 lines. Manuscripts must be typed, double-spaced, and submitted in two copies. Identify entries by title only and attach a cover sheet indicating author's name, address, duty phone, unit, and home address. Please include a brief biography.

The contest is open to all. Entries qualifying under the above rules earn their author a complimentary one-year subscription to *TMF*. However, desk sets and plaques may only be awarded to military members and civilian employees of the Department of the Air Force and Air Reserve Components. Other entries may be selected for Honorable Mention Special Category.

Winning entries will be published in *TMF*.

Submit to:

MAC Flight Safety Writing Contest, 1991
HQ MAC/IGFE
Scott AFB, Illinois 62225-5101



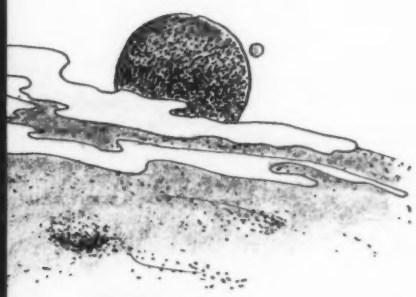
A TRIP IN

A lesson from the past.

By SMSgt. Tim E. Bridgeman
179 TAG, Mansfield Lahm Aprt, Ohio

HONORABLE MENTION
1990 MAC FLIGHT SAFETY WRITING CONTEST

TIME



The rain pounded relentlessly against the boarding area window. The darkness exploded into dazzling brightness as lightning flashed across the sky! It was not a night for traveling. Many galactic carriers had canceled their flights, and it was safe to assume the rest would soon follow. In the waiting area, travelers sat nervously awaiting the final boarding call. Among them sat a young man wearing a Galactic Airlift Command uniform. The uniform signified a professional, and Ben Williams was proud of his position as a cargonaught in the command. He took pride in wearing his uniform.

To be selected as a intergalactic cargonaught was the dream of many young people. Only the top ten percent of those completing cargonaught school were considered for intergalactic flight. Ben had been in that ten percent. He was assigned, after graduation, to the J-39 cruiser, the newest of the fleet. The J-39 has all the latest technology and is a much-sought-after assignment. It is used for flights to the farthest reaches of space and carries a crew of 20. There are seven primary flight crew, three cargonaughts, and ten passenger specialists. The J-39 can easily carry 350 passengers and over 400 tons of cargo. Inside the passenger capsule, individual compartments provide every possible creature comfort. As technologically superior as the J-39 is, it has two weaknesses in its design. The first is that the air for the passenger capsule is drawn from the cargo compartment ventilation system. The air goes through a filtration system which is less than adequate for the job, sometimes allowing cargo fumes to mix with passenger capsule air. The second concerns the hatch used for access to the cargo hold in flight. It is located in the aft bulkhead of the passenger capsule. Access to the cargo hold, which is located directly beneath the passenger capsule, is gained through the hatch and down a circular stairway. Because the hatch is heavy and difficult to operate, a lot of crews fly with it wide open.

Galactic space passenger travel has been going on for years and is very common. Procedures for launch are refined to the point that crews are not picked until three weeks before liftoff. The payload is selected by priority and passengers are handled on a first-come first-served basis. The six days before a launch are so hectic that most cargonaughts often feel they have lost all control. Only after launch do they get a chance to catch their breath.

Because of the small number of intergalactic cargonaughts, leave is very difficult to obtain. Ben had just completed his tenth flight with the G.A.C. when he received word that his leave had been approved. He had gone home for a much-needed rest.

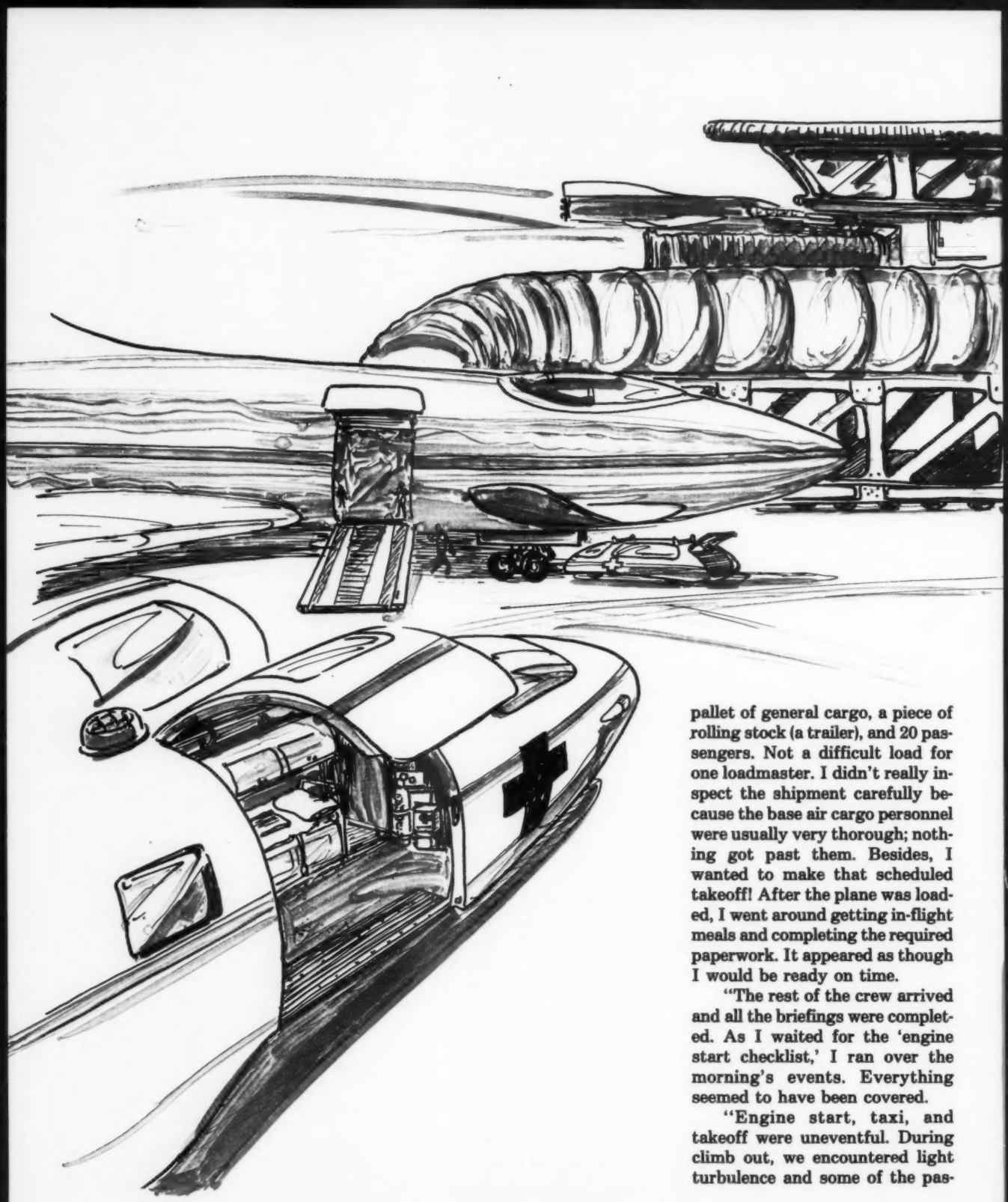
As Ben waited for his flight, he reflected upon his leave. He had learned a great deal about his ancestors. His family had a long history of galactic service, and Ben was proud to continue this tradition. Ben and his father talked about Ben's position and how important it was. During one of these talks, Ben's father told him his great-grandfather had been a loadmaster, as they were called in those days, on a small global airfreighter called a C-130. He was sure some of the old manuals were still around. Ben decided to look for them the next day.

Morning found Ben awake and anxious to get started. After a long search, he found an old footlocker that had belonged to his great grandfather. Under a pile of old uniforms were the ancient books. The first contained information covering flight characteristics of the C-130. The second had instructions on loading and securing cargo, and the third, instructions on proper handling of hazardous cargo.

Next to the manuals, Ben found a diary written by his great-grandfather. As he leafed through it, one entry caught his attention. Shaky handwriting told a tale of concern and near tragedy.

"15 July 1988. We arrived late after a very long day. Everyone was extremely tired and looking forward to crew rest, even though it would be the minimum. Our mission the next day was another long one. The crew bus was delayed and our passengers arrived at billeting ahead of us. After another long delay we finally arrived at our rooms. An unfamiliar bed made a good night's sleep impossible. Delay after delay the next morning ensured a late arrival at the airplane. With time short, speed was required. Luckily, my cargo was waiting for me.

"The load consisted of one



pallet of general cargo, a piece of rolling stock (a trailer), and 20 passengers. Not a difficult load for one loadmaster. I didn't really inspect the shipment carefully because the base air cargo personnel were usually very thorough; nothing got past them. Besides, I wanted to make that scheduled takeoff! After the plane was loaded, I went around getting in-flight meals and completing the required paperwork. It appeared as though I would be ready on time.

"The rest of the crew arrived and all the briefings were completed. As I waited for the 'engine start checklist,' I ran over the morning's events. Everything seemed to have been covered.

"Engine start, taxi, and takeoff were uneventful. During climb out, we encountered light turbulence and some of the pas-

sengers became uneasy. I was able to calm them with a brief word here and there.

"Twenty minutes into the flight I felt the initial twinge of a headache and attributed it to the previous long day and restless night. A few minutes later, a passenger complained of dizziness and a headache. One by one, the rest of the passengers displayed the same symptoms, and I became concerned! I notified the aircraft commander who told me to monitor the situation and let him know if things became worse. Some of the passengers then started complaining of nausea, so the aircraft commander decided to find a place to land.

"As I prepared the airplane for landing, I checked the tiedown devices on the trailer and noticed a puddle of fluid. It had not been there when I completed my after-takeoff checks. I became concerned because I was not briefed about liquids in the load! It suddenly dawned on me that this leak could be toxic and responsible for the discomfort everyone in the compartment was experiencing. I notified the pilot who declared an emergency. Then I had the passengers don the Personnel Oxygen Kits we carried. The crew on the flight deck also went on oxygen, just to be on the safe side.

"The landing was uneventful, and the plane was met by medical personnel. We were taken to the base hospital, given a thorough examination, and kept overnight for observation.

"The pilot visited me later that evening and informed me that the leak was, in fact, a toxic fluid! We were very lucky! Another 30 minutes of inhaling the fumes could have resulted in severe casualties.

"We all spent the night in the hospital and were released the next morning. The trailer had been removed and the leak cleaned up. We completed the mission without further incident.

"An investigation followed, and the trailer was traced to a civilian contractor. The contractor had never shipped anything on a military aircraft before and was not informed about the regulations. Personnel at the onload base were not aware of the toxic fluid and, due to the large number of aircraft to load that day, they had not inspected the cargo. I compounded the problem by not inspecting the load myself; not doing my job. I let my concern for an on-time takeoff override my excellent training, good judgment, and old-fashioned common sense. I vowed to never let that happen again! I was not going to be pressured into neglecting my duties!"

Ben put the diary down and shook his head in disbelief. How could his great-grandfather let something that critical get past him? Because of his carelessness, 21 people had been hospitalized.

Ben was sure something like that couldn't happen now, or could it? He knew what pressure for an on-time launch was like. As a cargonaught, he was responsible for the cargo but did not observe its buildup, just like his grandfather. He did not load the J-39—payload specialists served that function. Ben thought of the two flaws in the J-39; the open hatch between the passenger capsule and cargo bay and the poor ventilation system. He tried to visualize what a toxic leak could do on a space flight! He tried to imagine what havoc it could cause! Just the thought of it made Ben shudder. He realized the experience his great-grandfather related could, in fact, happen again, but with more serious consequences.

As Ben reflected on that musty diary entry, he imagined how his great-grandfather must have felt. Ben had cut a few corners himself to ensure an on-time launch. He shuddered as he thought of those 350 passengers and what could happen to them. So Ben, like his great-grandfather, made a vow that he would never let anything deter him from doing his job the way it's supposed to be done.

A chill ran up his spine as Ben realized he was heeding a voice from the past, a voice of experience. It wasn't speaking from a lesson disk, a regulation, or the grave. It was speaking from a real-life situation about real people; a person who made an error and learned from it. Ben remembered one of his instructors mentioning that that's how they did it in the "old blue-suit days;" the young learned from the old through personal contact. "We should revive that idea," he mused loudly, "it could help reduce our mishap statistics."

Just then, an announcement to cancel the flight was made. Things aren't so different today, after all, thought Ben, maybe I can learn even more from great-grandad's diary.

SMSgt. Tim Bridgeman has over 22 years of combined active duty and Air National Guard service, including eight years as a crew chief on fighter aircraft. For the past 14 years he has been a C-130B loadmaster and has twice represented the 164 TAS in AIRLIFT RODEO competition. Sergeant Bridgeman is currently the NCOIC of the loadmaster section and a unit evaluator. "A Trip in Time" is his second submission to *TMF*, his first attempt received honorable mention in the 1988 writing contest.

Ice History

How we got where we are.

Mother Nature has always presented challenges to man's quest to further the state-of-the-art in many fields. This is most evident in the field of aviation. Nevertheless, man generally finds a way to review the available reserve of knowledge, apply it to the problem at hand, and develop a solution. Aircraft icing is one of the major weather hazards to aviation. We believe the information presented will prove interesting-both as a reminder to those who were there and as a lesson in history for newcomers to aviation.

History is rich with stories of intrepid airmail pilots struggling with the elements. While the hand of Mother Nature was known, little was done through the early 1930s to conquer her challenges. Consequently, early flying machines were limited to fair weather daylight flying.

During the mid-1930s, much became known about the effects of ice, including the facts that:

- it increases drag and reduces lift
- it increases the weight of the airplane
- it causes control surfaces to become unbalanced and/or frozen, fixed slots to become filled, and moveable slots to jam
- it causes destructive vibration of accessory parts
- it has a detrimental effect on true instrument readings
- it endangers engine performance
- it degrades radio reception

The formation of ice is controlled by the laws of basic physics. Ice is known to form when moisture is present in visible form and the temperature is below 32 degrees F. (Under certain conditions of moisture, induction system icing may occur when the ambient temperatures are as high as 50 degrees F.) Under these conditions, the ice formation may be either

glaze (clear) or rime (opaque). The type of ice formation which occurs is related to the surface temperature. In addition, frost (a light crystalline structure) may form when the airplane is left in the open on clear, cold nights. There are four methods of eliminating ice:

- melting—by applying heat
- evaporation—by applying more heat
- mechanically—by breaking loose with deicer boots or other devices
- chemically—by applying deicing fluids

How to deal with Mother Nature has become an ongoing and tedious process. It would take a requirement for an all-weather-capable military to take the lead in developing equipment and techniques which would make these operations possible. The first challenge was to make airplanes capable of operating from bases which experienced extremely low temperatures (i.e. solving engine starting and system leakage problems). Next would come a capability to fly under icing conditions.

During the early 1930s, Dr. William C. Geer was commissioned by the Guggenheim Institute to study ice control. After two years he determined that the most practical method would be to allow ice to form for brief periods and then break it mechanically. During the mid-1930s, B.F. Goodrich worked with Dr. Geer to develop a pneumatically inflatable rubber deicer boot for installation on wings and empennage of airplanes to break loose ice formations. Once loosened, the slip stream would carry away ice. Similar boots were tried on pitot tubes and antennas; however, experience showed that heated pitot tubes provided a better solution for this application. Heating was also employed on antennas.

In a concurrent program, B.F. Goodrich also developed a propeller deicing system in the fall of 1935. The program was sponsored by the U.S. Department of Commerce. Flight testing was conducted by Transcontinental & Western Air (predecessor of Trans World Airlines). An anti-freeze solution consisting of 85 parts by volume of denatured ethyl alcohol to 15 parts of chemically pure glycerine, was fed from a reservoir through tubing to a slinger ring mounted on the propeller hub. The fluid was directed along a grooved rubber boot on the leading edge of the propeller.

In a 1937 report from the National Advisory Committee for Aeronautics (NACA), Theodore Theodorsen and William C. Clay discussed their heated wing tests which were conducted at Langley Field, Virginia. Their study showed that exhaust gasses ducted along the leading edge of the wing would heat it to about 30 percent of the chord. This degree of heating was more than sufficient to prevent the accretion of ice on the wing. The system was so efficient that only 10 percent of the available engine exhaust heat was required. However, their major difficulty was in developing an efficient ducting system which would carry heat along the full span of the leading edge.

Another NACA research team at Langley, under Lewis A. Rodart, conducted icing research in free flight in 1937-38. They built a model wing above the aircraft wing, sprayed water on this wing in flight to form ice, and then piped heat into the model wing

leading edge for deicing. A timed camera recorded the rate of ice removal for given amounts of heat. While the system worked in model form, it was impractical for use on an airplane. The weight of the heating system was prohibitive. In addition, improper heating has a detrimental effect on the strength of the aluminum structure. For aluminum alloys of the day, there was a 50 percent strength loss when the temperature exceeded 300 degrees F. These hot wing tests continued throughout the 1930s and early 1940s. The NACA icing research team was transferred to the new Ames Aeronautical Research Laboratory at Moffett Field, California, in 1941, where the topography and weather were more conducive to producing natural icing conditions. Between May 1944 and July 1949, a handfull of airplanes were loaned to NACA for testing. A B-24M was operated between November 1945 and July 1949. This airplane was employed in a variety of icing tests and was reconfigured drastically to meet the test requirements. Today, much of the follow-on ice research is still conducted at the NACA Lewis Research Center.

In July 1934, a U.S. Congressional board recommended that the U.S. Army Air Corps conduct cold-weather testing and training in Alaska. Consistent low temperatures made Alaska an ideal site for these operations. Political wrangling, however, would keep this recommendation from coming to fruition until the fall of 1939. Ladd Air Base, three miles east of Fairbanks, was officially dedicated on 4 September 1940. A pair of Boeing B-17B *Flying Fortresses* were dispatched from the Sacramento Air Depot to Ladd for testing. Five aircraft types were assigned to the first test program, two of which were lost. A total of 800 hours was accrued. While the winter was not the coldest (temperatures averaged -25 degrees F., with a low of -47 degrees F.), much was learned from the operation. Major findings were:

- Movement in and out of hangars caused the aircraft to *sweat*, resulting in icing.
- Alternate freezing and thawing resulted in cracked windshields, canopies, hydraulic lines, and seals.

Testing was resumed during the winter of 1942-43 under the reestablished Cold Weather Test Detachment from the Army Air Forces Proving Ground Command. This time a team of 80 was assembled for the operation. In addition to military personnel from Wright Field, Ohio, there were civilian representatives from Allison, Bell, Boeing, Curtiss Wright, General Electric, and Republic, along with others from subcontractors. The team was almost evenly

divided between civilian and military personnel.

Aircraft employed in these new rounds of tests had the benefit of winterization based on the previous tests. In addition, the experiences of both Allied and enemy air forces were analyzed for further ideas. Examples of German and Russian technology, gleaned from intelligence reports, included the following:

- The Germans had developed hot air leading edges for deicing. Muffs installed around the engine exhaust manifold collected hot air which was ducted to wing leading edges. (This may have been an adaptation of the earlier NACA tests.) A hot air spray was also ducted onto the pilots' windshields. Deicer boots were installed on the empennage. Propellers were deiced with a slinger-ring installation.

- The Russians had come up with a wing deicing system known as the AP-3 designed by an engineer named Fidelson. It was similar to a British-designed system which permitted fluid to ooze out the wing leading edge through small holes.

- The Russians also developed a mixture of light oil and chalk which was applied over the aircraft surface as a frost inhibitor. This mixture consisted of one part finely ground chalk to four parts of lubricating oil. Six or seven liters was sufficient to cover 50 square meters of surface area. However, this substance would have to be physically removed before

flight because of its tendency to cause the formation of ice in flight.

From these studies in 1943 came almost 150 individual reports and a requirement for military aircraft to be capable of operating in temperatures as low as -65 degrees F. Annual winter testing was conducted with renewed vigor as a result of the 1943 program. From then until the late 1940's, every major U.S. military airplane type was subjected to cold weather testing in Alaska.

The Cold Weather Test Detachment was subsequently reassigned to the U.S. Air Force's Research and Development Command and later the Air Force Systems Command. Since the completion in 1947 of the climatic hangar at Eglin Air Force Base, Florida, much of the testing on entire airframes has been conducted in this more reliable and less expensive facility.

Northwest Airlines worked under contract for the USAAF's Air Transport Command and later the Wright Field Army Experimental Station to perform ice research. Between 1943-46, Northwest provided engineers, mechanics, and pilots to perform these tests out of Wold-Chamberland Airport in Minneapolis where ideal natural icing conditions existed.

Data from these tests permitted the U.S. Army Air Force's Air Technical Command to issue a report in February 1946. The study produced calculations for the trajectories of small water droplets (such as in fog) in air moving at high velocities across a cylinder. The objective was to determine the conditions under which the droplets strike the surface of the cylinder. As a result, it would then be possible to determine the conditions necessary for the formation of ice on any parts of an airplane which simulated cylindrical surfaces (i.e. wing leading edges, antennas, etc.). It would then become possible to predict the rate of ice formation on an aircraft moving at high speeds. The experiments also yielded a way to predict the rate of ice formation when certain sized water droplets were present.

Expanding on the water droplet trajectory studies, rotating probes were used to determine the rates of ice accretion. Motor-driven probes were installed on the forward fuselage of the airplane for the latter tests. The probe would be extended into the slip stream and rotated to ensure an even coating of ice. When coated, the probe would be retracted, photographed, deiced, and reinserted into the slip stream. Extrapolating from the earlier studies, sizes of water droplets in the atmosphere could be determined from the rate of ice accretion. Probes of specific diameters would pick up ice generated by specific sized water droplets. From these tests it was learned that ice accretion would occur on rods of certain sizes. This data was extrapolated for use in subsequent studies on wing icing.

During the late 1950s, researchers developed the design standards for wing deicing. They combined data from atmospheric sciences and heat transfer studies on cylinders (i.e. wing leading edges) and flat plates (i.e. wing upper and lower surfaces) to determine how much of a wing had to be ice-free to sustain flight. The determination was that the wing had to be ice-free as far aft as the center of lift.

Enough heat had to be put into a wing to vaporize all of the water content. Now the amount of heat required to accomplish the deicing could be calculated. With the advent of supersonic jet aircraft, testing revealed that there was sufficient aerodynamic heating in cruise to prevent the accretion of ice. It was found that the top of the icing envelope was usually 22,000 feet. However, under certain conditions, ice can occur at altitudes between 22,000 and 40,000 feet. While the icing problem essentially went away with jets in cruise, the problem still exists for takeoff, approach, and landing for any aircraft.

Engine icing was also a major concern. For reciprocating engines, a carburator heat system was developed. With the advent of the jet engine, it was initially believed that an anti-icing system would not be required. However, on 8 June 1951, the U.S. Air Force dispatched a formation of 71 F-84 *Thunderjets* in 16-ship elements for a flight from Wright-Patterson AFB, Ohio, to Bergstrom AFB, Texas. Eighteen minutes into the flight, the second element encountered severe weather conditions resulting in the loss of eight aircraft and five others making wheels-up landings in nearby fields. It was subsequently learned that the engine inlet guide vanes had iced over causing the engines to flame out. Extensive studies were conducted to develop an anti-icing system for the jet engines. The result was an engine bleed system for heating the inlet guide vanes and engine nose dome; a system which is employed to this day.

As a result of extensive ice research studies conducted between the mid-1930s and mid-1950s, most airplane design criteria were developed. Since that time, some refinements have been made in the way engineers tackle the problem of icing. Today, the FAA has a major effort under way for development of a new engineering guide.These studies are being performed at the NASA Lewis facility in conjunction with Ohio State and Wichita State Universities.

While Mother Nature's effect on airplanes in winter has not changed over time, man's ability to cope with her icy blasts has slowly evolved to make operations more efficient, and reliable, under most extreme weather conditions.

Adapted by permission from: *BOEING Airliner*

Sleep on Long-Haul Flights

Rest during long-haul flights improves pilot alertness. That's the conclusion of a recently completed NASA/FAA study now under FAA's review.

The study provides the first concrete evidence that there may be substantial safety benefits from allowing pilots to obtain limited rest in the cockpit during long-haul, international flights.

"These findings confirm our previous studies that showed international flight crews often experience considerable fatigue and sleep loss," said Dr. R. Curtis Graeber, principal investigator for the study and chief of the Flight Human Factors Branch at NASA's Ames Research Center.

"We now have direct scientific evidence that short, carefully controlled rest periods can act as a 'safety valve' to reduce fatigue and improve alertness during the most important phases of flight—such as descent and landing."

Incident and accident reports indicate that good flight crew performance is especially important near the end of any flight when work load increases and the crew must often deal with air traffic control problems, uncooperative weather, and potentially unfamiliar airports.

"Unfortunately, this is also the time when they are most likely to be the most tired—after a long trip crossing several time zones," said Graeber.

The NASA/FAA-sponsored research project was carried out with the cooperation of Northwest and United airlines during

regularly scheduled trans-Pacific flights.

The scientists examined the levels of alertness in three-person flight crews during long-haul flights, the pilot's ability to obtain quality rest in the cockpit environment, and the effectiveness of preplanned cockpit rest periods to improve pilot alertness and performance.

A total of 10 volunteer Boeing 747 crews were placed in one of two groups: a preplanned rest group and a non-rest control group.

Crewmembers in the rest group were allowed to rest one at a time on a preplanned rotation basis during the cruise portion of four successive flights.

Two crewmembers monitored and maintained control of the plane while the other pilot had a 40-minute opportunity to rest.

The control group of pilots operated its four flights as usual with no preplanned rest.

To document changes in fatigue and alertness, researchers took a variety of measurements:

- Laboratory-type performance tests evaluated pilot vigilance and sustained attention.
- Wrist monitors provided a 24-hour measure of activity level.
- Subjective reports of mood and other factors were recorded in a log book.
- Continuous measurement of brain activity—electroencephalogram (EEG), for example, by a portable unit adapted especially for NASA—was used to determine physiological levels of alertness.

Two NASA researchers observed and monitored all of the volunteer crews on the flight deck.

The researchers found that when given the opportunity to rest in their seats, the pilots generally were able to fall asleep easily and slept well.

Later, these crewmembers demonstrated significantly higher levels of vigilance than their counterparts who had no rest.

These differences between the two groups were especially dramatic near the end of the cruise phase of flight, just before the pilot started the descent for landing. Also, pilots who could rest were less adversely affected by consecutive flight segments and night flights.

Previous research with long-haul crews showed that repeated time zone crossings often result in poor sleep patterns during hotel layovers, particularly after eastward flights.

While pilots sometimes sleep well, their ability to do so varies among individuals and is changeable.

Experienced crewmembers were found to be poor predictors of their own sleepiness when compared with objective measurements.

The overall impact of these findings is that there is often at least one crewmember performing flight duties who is not optimally rested.

The current results demonstrate that preplanned rest periods during low work load phases of flight may provide a safety valve for the sleep loss and fatigue experienced by crews during long-haul flights.

MAC has long recognized the importance of optimum use of crew rest time. As we have seen recently, with extended duty days and minimum turn times, crew fatigue can quickly become a limiting factor in sustaining a long-term operation. It is therefore imperative that we not only manage our crew rest periods to adequately get the needed rest but that we manage our crews to afford the maximum rest consistent with flight duties.

sleep well, their ability to do so varies among individuals and is changeable."

Courtesy of *Headquarters INTERCOM*

Excellence in Airmanship

Sgt. Randy K. Crapps, 62 TAS, Little Rock AFB, Ark.

Sgt. Randy K. Crapps, 62d Tactical Airlift Squadron, Little Rock AFB, Ark., was the primary loadmaster on a C-130 crew flying a mission on 9 March 1990. The crew completed the airdrop portion of the mission and began the airland portion requiring the student pilot to perform multiple short field landings on a 3,500-foot by 60-foot assault zone. One such landing had just been completed when the flight deck crew heard a muffled sound (like breaking rock) as they turned off the assault zone. The instructor pilot (IP), believing the noise originated from the nose wheel well area, directed the flight engineer (FE) to deplane and inspect the gear. After the exterior inspection, the FE reported the nose gear was fine and nothing appeared unusual with the main gear. The IP decided to continue the mission and began to taxi for takeoff.

During taxi, Sergeant Crapps took the initiative to internally check the main landing gear. It should be noted that loadmasters are not trained in the intricacies of the operation of the main landing gear, nor is it a part of their crew duties to check the main landing gear while on the ground. During Sergeant Crapps' inspection, he noticed that "something was not right." He believed there was something wrong with the left main landing gear drag pin, so he advised the crew and asked the FE to verify his inspection. The student pilot stopped the aircraft and the flight deck crew heard the "cracking" sound again. At this time, the FE advised the pilots not to taxi further. He confirmed the aft drag pin preventing lateral movement had indeed sheared and the entire gear assembly had moved outward approximately one inch. Had a takeoff and landing been made, the left main landing gear could have collapsed.

Sergeant Crapps demonstrated knowledge of aircraft systems beyond the level required for performing his crew duties. His airmanship and initiative possibly prevented a serious mishap and possible loss of life. He is well deserving of the MAC Excellence in Airmanship Award. Congratulations from *TMF*.

Flying-Hour Milestones

15,000

166 TAG
SMSgt. John R. Quigley

10,000

17 MAS
Lt. Col. Anthony J. Lolas

185 TAS
Lt. Col. Robert L. Bordwine, Jr.

437 MAW
CMSgt. John J. Giles

446 MAW
SMSgt. David K. Trueblood
MSgt. Michael T. Golden

7,500

22 MAS
SSgt. Ronald S. Nagy

50 TAS
CMSgt. David E. Rodgers

57 MAS
TSgt. John J. Hart

193 SOG
Brig. Gen. Adolph P. Hearon
Col. Walter R. Ernst, II.
Lt. Col. Lawrence D. Miller
Lt. Col. John S. Schreckengaust
SMSgt. William W. Bickel, Sr.
SMSgt. Alan D. Kapp
SMSgt. Warren C. Miller
SMSgt. Gene R. Soliday
SMSgt. James M. Spittle
MSgt. Augustine J. Interrante

446 MAW
Lt. Col. Edward M. Duchnowski

5,000

Det 2, MACOS
Lt. Col. Robert W. Hale

11 AAS
Lt. Col. Frederick G. Padgett/CC

16 TATS
SMSgt. Jerry L. Justice

21 TAS
SSgt. David J. Paltz

22 MAST
Sgt. Howard E. McBound

50 TAS
SMSgt. Henry J. Allard
MSgt. Michael A. Switser
SSgt. Jeffrey D. Hamma

57 MAS
Maj. Charles D. Suggs
MSgt. Raymond F. Brzozowski
TSgt. Manny J. Garcia
TSgt. Jeffrey M. Knight
TSgt. Thomas D. Lee

61 TAS
Maj. Jimmie L. Lincoln
Maj. Roger A. Noll
MSgt. Allen D. Gardner
TSgt. Archie B. Kirchner
TSgt. Cecil C. Tucker

62 TAS
SSgt. Jerome L. Graves

86 MAS
TSgt. Michael L. Pierce
TSgt. Edward L. Ungerman

164 TAG
SMSgt. Charles R. Ritter

179 TAG
Maj. William H. Walker, IV.
SMSgt. Tim E. Bridgeman

193 SOG
Col. Lawrence F. Santerini
Lt. Col. Wayne Alden
Lt. Col. Robert J. Ledrew
Maj. Joseph M. Maleski
Maj. Dirk M. Suereth
MSgt. Terry L. Rarig

305 ARS
MSgt. William T. Shaw
TSgt. Niki Zachary

446 MAW
Lt. Col. James R. Aversman
Maj. Monty A. Courteau
Maj. Wallace W. Farris, Jr.
Maj. Vernon B. Jeremica
Maj. Dennis G. Kirby
Maj. Phillip A. Sanborn
Maj. Raymond E. Wallace

907 TAG
MSgt. Gerald T. Minihan, Jr.

910 TAG
Lt. Col. James R. Wagner
Maj. Mark E. Rensi
MSgt. Frank J. Marino

2,500

1 MAPS
SSgt. Jarvis V. Vanderpool

Det 2, MACOS
Maj. Robert A. Ain, Jr.
Maj. Robert G. Mignard

3 MAS
Maj. Howard E. Bohlin

9 MAS
Lt. Col. Stephen M. Jones

16 TATS
SSgt Dale C. Schilf

31 MAS
Lt. Col. William W. Hodges
Capt. Keith D. Krause
Capt. Kelly J. Scott
Capt. Stephen L. Waters
SSgt. David I. Lewis

50 TAS
Lt. Col. Martin J. Brown
Lt. Col. Bert J. Wampler
Maj. Scott R. Hansen
Maj. Rodney G. Hinrichs
Capt. Alan D. Babcock
Capt. Kent D. Bosworth
Capt. Ronald J. Harlow
Capt. Douglas W. Luhrsen
Capt. John S. Therwhanger
Capt. Fred L. Wood
CMSgt. Charles T. Windham
TSgt. Sergio E. Melara
TSgt. Bruce B. Soto
Sgt. Donald A. Miller

193 SOG
Lt. Col. Richard L. Bashore
Lt. Col. Ricky B. Burkey
Lt. Col. Richard S. Guise
Lt. Col. Michael G. James
Lt. Col. Robert J. Kocher
Lt. Col. William C. Korner
Lt. Col. Craig A. Obeck
Lt. Col. Ronald L. Shultz
Maj. Frank P. Arcury
Maj. James E. Astor
Maj. Robert A. Beers
Maj. Raymond J. Davis
Maj. Richard W. Fidler, Jr.
Maj. Larry W. Foreman
Maj. Dennis R. Goodling
Maj. Steven D. Guinter
Maj. John S. Hiller
Maj. David L. Jannetta
Maj. Lyndon J. Kellogg, Jr.
Maj. John W. Kilkenny, III.
Maj. Craig E. Lady
Maj. Thomas H. Mills
Maj. David S. Valentine
Maj. John W. Wanat
Capt. Randy J. Chapman
Capt. Mark D. Gallant
Capt. John M. McCarthy
Capt. Richard V. Voll
SMSgt. Harold L. Bowman
SMSgt. Barry H. Wolfe
MSgt. Michael F. Acri
MSgt. Robert W. Anderson, II.
MSgt. Daniel Bourinski
MSgt. James L. Buffington
MSgt. Don J. Caruso
MSgt. Stephen L. Durnin
MSgt. Charles H. Geyer, Jr.
MSgt. Marlin L. Haldeman
MSgt. Paul W. Heisey
MSgt. Terry M. Jones
MSgt. Ronald L. Kaylor
MSgt. Gene A. Measbey
MSgt. Edward J. Moravetz, Jr.
MSgt. Paul B. Sheffer
MSgt. Francis C. Strohecker
MSgt. Raymond L. Welgross
MSgt. Blaine E. Wiley
MSgt. Timothy L. Young
TSgt. David R. Brunner
TSgt. Michael B. Caflin
TSgt. John W. Drayer
TSgt. Jess W. Durham
TSgt. Robert A. Heffner
TSgt. Russell B. Howell, Jr.
TSgt. Michael E. Roth
TSgt. Vaugan L. Schwalm
TSgt. Todd A. Sheffer

435 TAW
Capt. Andrea B. Childers
Capt. Carl E. McDaniel
SSgt. Jody R. Woitas

463 TAW
Col. Robert A. Maguire/CC

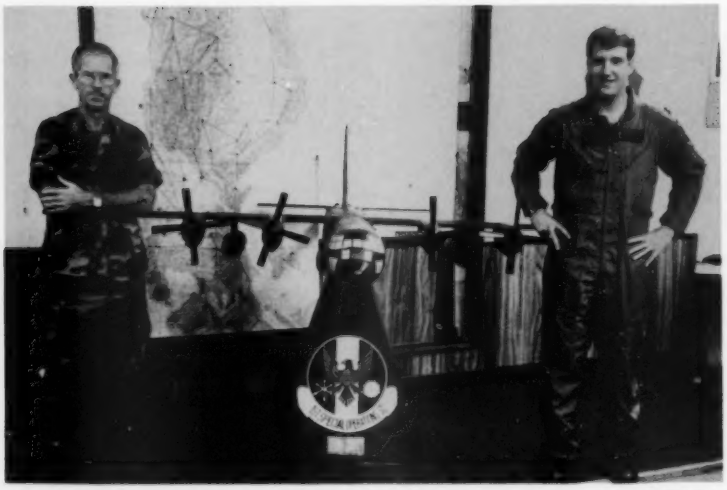
773 TAS
Capt. John Reed

907 TAG
Capt. David P. Russell

910 TAG
Maj. Richard L. Linteris
Maj. Roger W. Reynard
Capt. Timothy S. Costa
MSgt. Bruce L. Foist

* Ranks and units are those at time of award. ➢

353d SPECIAL OPERATI



Lt. Col. Terry Silvester (left), 1 SOS /CC and Capt. Kevin Grzegorczyk, 1 SOS/SE, with a downsized version of the unit's aircraft.

MC-130E over Northern Luzon.

Maj. Charlie Williams (left), 353 SOMS/CC, on the flightline.

MSgt. Justin D. Hughes, 353 SOW/SEG, conducting a spot inspection.

By Maj. Dale Van De Ven
Associate Editor

"Special operations is not a capability, it's an attitude. The folks in special operations have an attitude that may be a little different. We find ourselves at the point of the spear." With this introduction, Col. James P. Nance, Commander, 353d Special Operations Wing (SOW), Clark AB, Republic of the Philippines, welcomed me to the world of special operations.

In April of this year, the 353d celebrated its first birthday.

IONS WING

Capt. Marc Stratton (foreground), Det 2, 1723 STS/CC, preparing for a jump mission.

Lt. Col. Dale Cook, 31 SOS/CC, attending a mission briefing. L to R, TSgt. Michael J. Darling, Lt. Col. Dale Cook, Capt. George Niles, and Capt. Bruce Vanskiver.

According to Colonel Nance, the five squadrons making up the unit have meshed together and the wing is ready for any contingency. Prior to establishment of the 353d, Clark was already home for two of the wing's three flight squadrons. Colonel Nance pointed out that both the 1st Special Operations Squadron (SOS), flying MC-130 Talons, and the 31 SOS, with H-3s, had been operating here for quite some time, but "They didn't function as a unit. Now we've pulled them together. We've also established the 17 SOS, with HC-130s, up at Kadena AB, Japan. Their mission is to refuel helicopters but we're trying to expand that to include airlift as well. The shortfall of Talon-type airlift is significant. We've got a heck of a lot more to do than we can do with a limited number of Talons available. Those tankers can add to our capability and that's what we're working toward."

The wing's other major airframe, the H-3 helicopter, will be replaced shortly with MH-53 Pave Lows. Colonel Nance's ties with the H-3 go back quite a few years. "The H-3s have been around forever. As a matter of fact, they were my first operational assignment 20 years ago and we have some of those same aircraft here now. The birds are about to retire, and we're excited about the Pave Lows coming in but that doesn't in any way diminish the fact that the H-3s have done a superb job of making things happen around here. The H-3s are as tactically capable and as operationally sound as any helicopter unit in the Air Force, and they will be until the day the last one ships out."

After departing Colonel Nance's office, my next stop was the 31 SOS where some background information provided by Capt. George Niles, 31 SOS/SE, showed that the unit had not had a major flight mishap since it started flying the H-3 helicopters in 1972. That's over 18 years and 20,000 hours of mishap-free flying.

The 31st flies some of the most challenging missions in today's Air Force. All aircrew members are qualified in Night Vision Goggles (NVGs), and the unit was among the first to qualify in new special missions such as NVG water operations, NVG air refueling, and simultaneous air refueling.

The 31st maintains an aggressive TDY schedule. Twice they have deployed to Thailand, a distance of over 2,500 miles, making it the longest H-3 deployment in the history of the airframe.

Over the years the 31st has saved hundreds of lives. Missions

Capt. Mark Schwalm (foreground), 353 SOW/DOI, leading the unit SOF FIT program.

Capt. Randy McCasaland, 353 SOW/SE, at the controls.

The philosophy behind the SOF FIT program.

have included hoisting people off the roof of a burning hotel, plucking shipwreck survivors out of the water, picking up people from the roofs of their flooded houses in Metro Manila during a typhoon, hoisting injured sailors from the decks of ships, and medevacing U.S. Peace Corps volunteers from remote locations.

When asked about his unit's impressive safety record, Lt. Col. Dale Cook, 31 SOS/CC, responded: "With the high temperature, the jungle, and the mountains, everyone learns to respect the environment there. Our pilots have to train a little harder in order to operate in it, and since they train a little harder, they become better pilots. They become more aware of that thin line between doing something safely and successfully, and not being able to accomplish the mission at all. I think people flying in safer environments never really have to rely on their piloting skills, especially in the H-3 which is a power limited helicopter. In our deployments, we see new areas and have to adapt; we learn to be very flexible."

Part of the 31st's safety success may well be attributed to Colonel Cook's attitude toward leadership. "I agree with the philosophy that squadron commanders had better be flyers. This really holds true in helicopters; especially in special ops. Unless you can fly, unless you can be there, unless you're 100-percent qualified in every single thing your squadron does, I don't see how you can be a squadron commander."

Having spent some time with the flyers in the 31st, including a night live-fire mission, I made my way over to the fixed wing side of the house. My host at the 1 SOS, Lt. Col.Terry Silvester, Squadron Commander, gave me his viewpoint on flying and safety. "Our mission is the long-range infiltration, exfiltration, and resupply of special operations forces to where they can do death and destruction to the enemy. I am very, very concerned about safety, but to say safety is paramount leaves me a little troubled because some of the things we do the average person would say are not inherently safe. We go out at night, in the mountains, flying with terrain following radar that's designed to clear us by 65 feet. Then we come back to a blacked-out runway and land using NVGs. That profile is not inherently safe. We're tasked with some very rigorous training. It's very intense, very hard flying. The Operations Officer and I can't be everywhere so we rely heavily upon our aircraft commanders to train and execute their missions safely. I put a lot of responsibility on those individuals."

After speaking with Colonel Silvester, it seemed logical to talk to an aircraft commander and find out what he felt was the most challenging part of the mission. Capt. Kevin Grzegorczyk, 1 SOS/SE, was quick to supply the answer. "As far as the mission and safety are concerned, without a doubt, the hardest part is crew coordination. We fly with up to a 14-man crew. A lot of our training missions are low level and the pilot will be getting three or four inputs continuously. The pilot is flying off the INS, the navigators will start to give headings, the EWO will be briefing on threats, and you'll be in the mountains, at night, flying at 250 feet, and not be able to see the terrain that well. You have things coming at you all the time, and it can get confusing unless the crew is really

disciplined and listening to each other. When a crew is really working well, when people are listening, talking, and doing what the books require, it's a safe but demanding mission."

Not all the people who fly on 353 SOW aircraft are aircrew members. Another important part of the special operations team consists of the men of the 1723d Special Tactics Squadron. Capt. Marc Stratton, Det 2/CC, provided some insight into his side of the operation.

"In the SOF world, CCT and PJs are together and are called special tactics squadrons. We're training together, working together, and trying to combine our tactics and procedures to have one set way of doing things. The PJs have always had a medical capability, and the CCT has always had air traffic control capability. Now we're combining the two.

"We do a lot of things around here that are inherently dangerous; jumping out of airplanes, fast roping from helicopters, and SCUBA diving. The combat controllers do some demolition work. All of these things involve a certain degree of risk, but what we strive to do is train to the point where we can all do these things in as safe a manner as possible. Then when we have to do it for real, it's done as safely as possible."

Whether you're wearing wings or not, everyone aboard a 353 SOW aircraft relies upon maintenance to provide a safe plane. My next conversation was with Maj. Charlie Williams, 353 SOMS/CC, who explained why his maintenance unit is different from others in the Air Force. "The primary difference is that we deploy, sometimes single ship, to very strange locations. We have created mini-support teams that go with the helicopters or the fixed wing aircraft. We try to keep things as tailored as we can to save space so we can attempt to take everything we may need with us. We just changed our name from the generic Consolidated Aircraft Maintenance Squadron (CAMS) to Special Operations Maintenance Squadron (SOMS). This makes us more identifiable with the special operations world.

"Another area that's unique to us is avionics. SOF avionics are probably the most complex and highly sophisticated avionics in the Air Force today. Down the road, things are going to get even more complicated with the arrival of the 53s. The Pave Lows will be another major challenge from the standpoint of equipment and just bedding the aircraft down. The training associated with them will be extremely intense.

"Most of the people involved in this world love it. The guys know that when there's a job to do it's 'real world.' There is a meaning behind it, and it's extremely serious. Yesterday we had a real world airevac. The phone call came in and they needed an airplane in an hour. Within ten minutes I had every supervisor in the squadron with everybody he owned out on the flightline. We had one ready to go in about 15 minutes and had two backups ready shortly thereafter. The response was unbelievable. We focus all our attention on generation and getting the job done, and we're going to continue to do it out of necessity and out of pride."

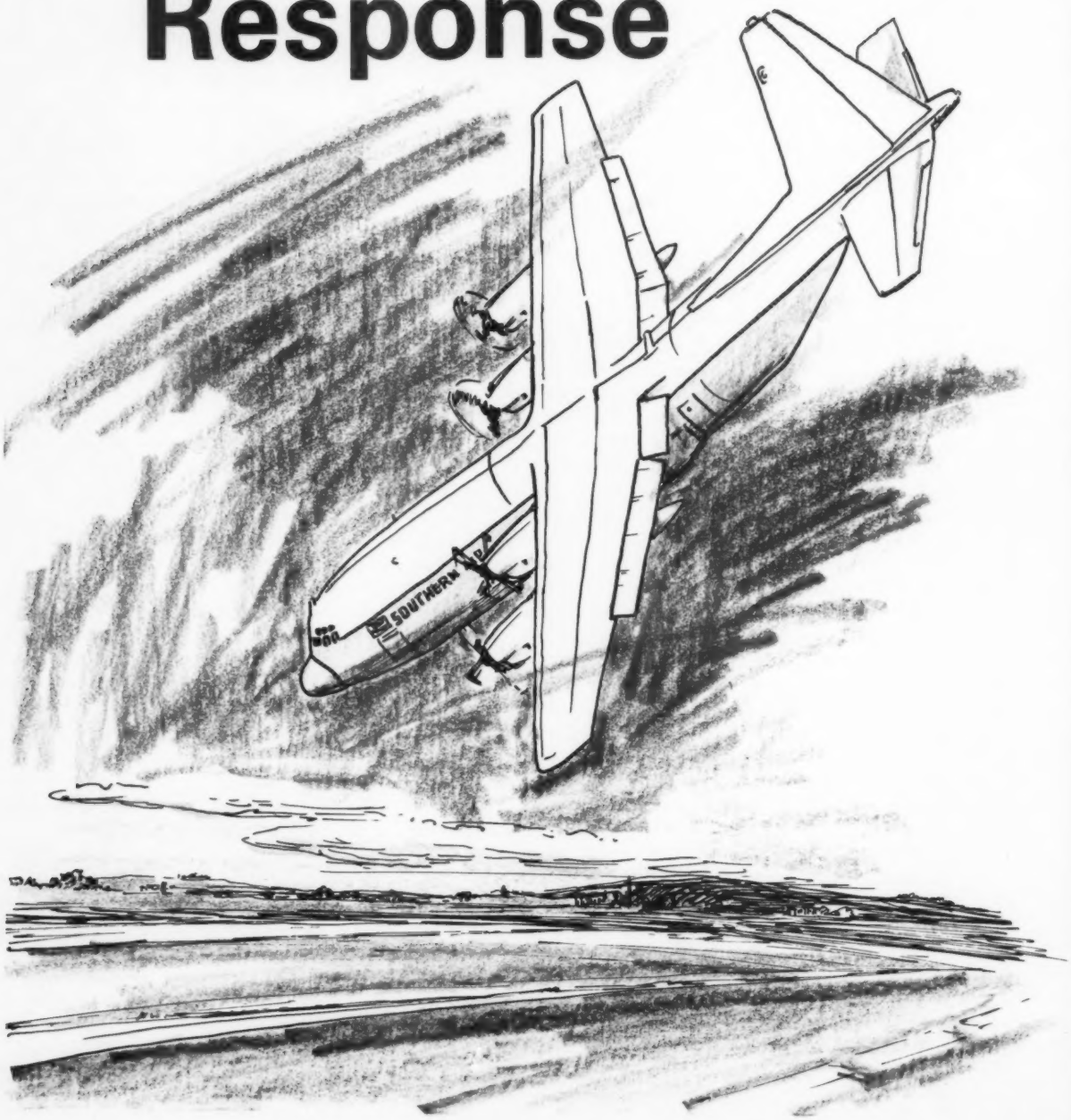
Unit pride was evident throughout the wing. One reflection of the seriousness with which the men and women of the 353d approach special operations is the SOF FIT program. Capt. Mark Schwalm, 353 SOW/DOI, outlined this wing level program for *TMF*. "SOF FIT is our part of MAC's FIT EAGLE program. The program is designed to help people improve their physical conditioning or, in some cases, start physical conditioning. We use a series of quick stretches followed by calisthenics and more stretching in preparation for the standard Air Force mile-and-a-half run or three-mile walk. Next we go to the gym and engage in group activities such as volleyball or basketball. Our commander is very supportive. He wants to see our people healthy."

A quick statistical review confirms that the 353d has an enviable safety record. Capt. Randy McCasaland, 353 SOW/SE, and MC-130 aircraft commander, has an explanation for his unit's low mishap rate. "Our rate can be attributed to the level of experience our crewmembers have. The only crew position we get right out of school is the EWO. The pilots and Navs have got from two to four years of C-130 experience before they come to us—very experienced and very professional. Everyone who comes to special operations is a volunteer—they want to fly the mission. Our mission is not boring; it's not a climb out, level off, and fly for 10-15 hours to land and enter crew rest. Every flight is hands on. You're working your tail off and coming back soaking wet. Very challenging, very demanding. I think we have one of the most dangerous missions in the Air Force, but it's done safely because our crews are professional. They want to be here and are happy with what they're doing."

Think about it, how can you do better than that?

(Editor's Note: TMF realizes that the 353d is no longer part of the MAC family. This article was scheduled prior to the change, and we recognized the importance of the 353d mission and felt we should publish it.)

Conditioned Response



Southern Air Transport (SAT) Flight 517, a Lockheed L-382G operating out of Travis AFB, Calif., crashed at 1732 PDT on 8 April 1987, following a practice ILS approach to Runway 21L at Travis. The flight was conducted in visual meteorological conditions for training of two First Officer candidates and a Flight Engineer candidate. All three had been hired by SAT within the previous 30 days. The Captain and Flight Engineer "check" airman aboard the flight had extensive experience in the L-382G airplane and its similar military C-130 version. There were no passengers or cargo aboard the flight. The airplane was destroyed by ground impact and a post-crash fire. All five crewmen were fatally injured.

FLIGHT HISTORY

Flight 517 departed Travis about 1157 and proceeded to Sacramento, Calif., where training was conducted and the airplane refueled. It returned to Travis and, after a partial crew change, departed at 1445 for a 3-hour local training flight. During flight, the crew conducted approaches and practice landings at McClellan AFB near Sacramento. The flight returned to Travis for completion of training.

Conversations recorded by the cockpit voice recorder indicated that the Captain intended to make a full stop landing following the ILS Runway 21L approach preceding the accident. During the practice instrument approach, the airplane was being flown by a First Officer candidate with no previous L-382G/C-130 flight experience. At 1729, the Flight Engineer reported that flaps were full (down) and the before landing checklist was complete. As the First Officer flew the approach, the Captain provided instructional guidance regarding altitude, airplane attitude, airspeed, and power corrections. Communications between the cockpit crewmembers were routine until moments before touchdown.

At 1731:21, the Captain continued to instruct the First Officer on pitch and power control for the landing phase. Just before touchdown, the Captain advised, "All right now, come off on the power . . . just raise the nose a little bit here." As the airplane touched down the Captain exclaimed, "Oh, oh, oh. I've got it, I've got it." He assumed control of the airplane and began a go-around. The CVR recorded sounds similar to engine winddown and a sound associated with a momentary electrical power interruption (to the CVR) as the Captain assumed control and the wheels touched down at 1731:40.

At 1731:45, the Captain asked, "We lost an engine?" Responses from the Flight Engineer check airman and Flight Engineer candidate were, respectively, "We lost one," and "Two, Skip." (Skip was the Captain's nickname.) At 1731:52, an unidentified crewmember said, "Flaps up." At 1731:57, the Captain stated, "Power on." The sound of impact was recorded at 1732.

The flight data recorder (FDR) indicated that the airplane touched down initially at 105 KIAS. Airplane heading remained within 10-degrees of runway heading for about 10 seconds after the Captain assumed control. Afterward, the airplane deviated rapidly to the left as the airplane entered a gradually steepening left bank. The FDR airspeed trace indicated airspeed also remained essentially stabilized for about 14 seconds, but deteriorated to 88 KIAS as the airplane turned left during the attempted go-around. Based on the heading change rate, it was calculated that the airplane's angle of bank reached about 50 degrees before impact.

ANALYSIS

Witnesses to the crash were located on and around Travis and in the control tower. They described a normal approach to Runway 21L until the airplane pitched upward near the touchdown point and rolled to the left. One of the tower air traffic controllers said he saw a puff of black smoke at the approximate touchdown point. Since tire scrubbing usually produces grey-white smoke, the Safety Board felt the tower controller observed a powerplant problem at the point where the go-around was initiated.

Witnesses said the airplane did not climb higher than 300 feet. The witnesses described a left bank at low altitude which steepened until the aiplane collided with the airfield perimeter fence in a nose-low and steep left wing low attitude. They observed an explosion, a ball of fire, and smoke immediately after the crash. Weather was not a factor.

As Flight 517 began the approach, Travis tower advised, ". . . wind 220 at 10, cleared to land Runway 21L. Caution, wake turbulence preceding heavy B-52." The Captain of Flight 517 acknowledged the information and read back the landing clearance. There were no further radio transmissions. It was determined that the preceding B-52 had been seven miles ahead of Flight 517 and made a touch-and-go landing on Runway 21L three and one-half minutes before the accident. Consequently, wake vortices from the B-52 were not considered to be a factor.

All major sections of the airplane and all control surfaces were found along the wreckage path. Examination of the airplane revealed no evidence of pre-impact failure or malfunction involving the airplane structure or flight control surfaces. There was no evidence of an in-flight fire or explosion. The wreckage indicated that landing gear was fully extended and flaps extended about 35 percent and symmetrical at impact. Company procedures state the normal position for flaps during a go-around, is 50 percent. The aileron, rudder, and elevator trim tabs were found in neutral positions. The aileron, rudder, and elevator booster assemblies operated when functionally tested after the accident.

All fuel crossfeed valves were found closed and all engine main tank fuel shutoff valves were open. Refueling records, fuel consumption calculation, and postcrash fuel gauge readings indicated there was a substantial amount of fuel remaining in each of the main tanks at the time of the crash. None of the engine fuel heater/strainer assemblies were obstructed by foreign material. Examination of the fuel system didn't reveal any indication of a problem that would cause a loss of engine power.

Examination of the left horizontal stabilizer and elevator aft of the Number 2 engine revealed a discolored area with a definite splash or spray pattern. Laboratory analysis confirmed the presence of engine oil streaking on the top surface. One witness reported that during the approach to Runway 21L he had seen a vapor or mist trail aft of the Number 2 engine that was different than smoke patterns aft of the other engines. The Safety Board determined that there had been recent, significant leakage of engine oil from the Number 2 engine. Analysis didn't confirm positively that there was significant leakage of engine oil on the accident flight or that leakage from Number 2 engine was limited to engine oil.

All of the propeller components that were not attached to individual assemblies were found along the wreckage path, except for a few small blade sections of Number 3 propeller which were found about 700 feet north of the remainder of Number 3 propeller. The blade roots of all 16 propeller blades were retained within their respective hubs. The propeller blades of engines 1 and 2 showed evidence of less power at impact than did blades of engines 3 and 4. Propeller disassembly inspections revealed blade angles of 28 to 30 degrees for propeller Numbers 1, 2, and 3 and a blade angle of 33 to 35 degrees for propeller Number 4. Testing revealed no evidence of pre-impact malfunction of the propellers.

All internal surfaces and components of Numbers 1 and 2 engine compressors were coated with a tar-like residue. A similar but less extensive oil/tar residue coated the internal components of Number 3 and 4 compressors. The Number 3 and 4 compressors also had ingested mud or dirt in the impact sequence, but dirt ingestion wasn't noted in compressors 1 and 2. Similarly, it was noted that Numbers 1 and 2 compressor 5th and 10th stage air bleed valve interior and exterior surfaces were coated with an oil/tar residue impeding proper actuation of some 5th stage valves. A heavy unbroken coating of residue indicated several valves were not closing during engine operation.

Turbine sections of Numbers 3 and 4 engines exhibited heavy blade rub and bending of blades opposite the direction of rotation. By contrast, turbine blades of Number 1 engine evidenced light blade rub; turbine blade rub wasn't found in Number 2 engine. This evidence combined with the condition of propeller blades indicated that Numbers 3 and 4 engines were operating and delivering power to their propellers until ground impact. The condition of engine compressor sections of engine Numbers 1 and 2 indicated that while the engines were operating before impact, the engines sustained a power loss related to oil/tar accumulation in the compressors and air bleed valves.

Testing of Number 2 engine, with functional bleed valves installed, revealed the engine produced 88 percent of rated power at the takeoff power point, over 20 percent loss in surge line, 9.6 percent loss in airflow, and 5.5 percent loss in compressor efficiency. These test results indicated that Number 2 engine was incapable of delivering normal power at the time of the accident.

A compressor wash using the prescribed cleaner was only slightly effective in restoring power. Walnut shell cleaning resulted in substantially improved engine performance. After such cleaning, the engine exhibited 100 percent of rated power at the takeoff power point.

The Safety Board conducted a detailed inspection of available maintenance records to resolve the source of the turbo-engine oil residues observed on the horizontal surfaces aft of Number 2 engine and the source of the tar-like residue found in the compressor gas path of Number 2 engine. The engines and propellers had a recent history of oil leaks. The Number 2 engine propeller was changed five days before the accident. Oil usage for Numbers 1 and 2 engines totaled six quarts each during the three days prior to the Number 2 engine change. Allison and SAT Maintenance Manuals contain procedures for nonroutine cleaning of engines using a liquid cleaner in the event of propeller or engine oil leaks. The SAT procedure required washing of engine compressors "any time visible contamination is suspect."

There was no record that SAT cleaned the engine compressors following any of the leakage events. The nature of the residues in the engines indicated long-term contamination. Company records indicated there were many lost opportunities to remove oil residues from the engines following oil leakage on other recent flights. Failure of maintenance to clean engine compressors following oil leaks in the months before the accident allowed the accumulation of oil residues in the engines and made them susceptible to related performance problems.

Evidence indicates that Numbers 1 and 2 engines failed to respond normally and, in fact, decelerated about 40 percent following throttle advancement at the commencement of the go-around. Despite the power loss, it is likely, at 60 percent rpm, that at least one of the two engines was producing sufficient power to maintain hydraulic pressure on the utility system (at some possible reduction in available pressure versus flow rate.) It is also likely the flap handle remained in an extended position, consistent with the 100 percent flap position selected for landing at the begining of the go-around. Thus, full hydraulic pressure to the rudder booster actuator was probably available initially, and the yawing moment produced by the asymmetry of thrust was probably controllable with rudder deflection.

Thirteen seconds after the Captain assumed control, a crewmember said, "Flaps up." In response, the flap handle was raised and flap retraction began. The flaps didn't retract completely, but reached the 35 percent extended position, indicating that utility hydraulic pressure was available in the last seconds of flight. The action of retracting flaps produced two adverse effects which probably resulted in an inability of the crew to retain directional control of the airplane: movement of the flap handle to the retracted position would have reduced rudder boost actuator pressure 21 percent, and demand for utility system hydrualic flow to the flap system might have resulted in a significant reduction of pressure in that system. The consequence of this action would have been a reduction in available rudder force, and a sudden decrease in rudder deflection despite efforts of the crew. Under these conditions, Vmca was significantly higher than actual airspeed, and the airplane began an uncontrollable yaw to the left. The immediate increase of aerodynamic drag further aggravated the controllability problem preventing the possibility of recovery in the go-around.

Soon after the Captain advanced the throttles, he should have become aware of the asymmetric thrust condition. This awareness should have been reinforced by crewmember's comments, the sounds of engines winding down, and changes in engine instrument indications. The Captain had substantial warning that the airplane was experiencing a loss of power from at least one engine, but this information didn't become apparent until the go-around had been initiated. After the go-around was commenced, the Captain either didn't promptly recognize that power had been lost from two engines or that the loss of power would potentially render the airplane uncontrollable at the speed at which the go-around was initiated.

In retrospect, it is clear the best decision at that time would have been to reland the airplane. However, the Captain was able to maintain runway heading for about ten seconds, and his decision to continue may have been influenced initially by the absence of an apparent control problem. Also, the pilot may have been able to control the airplane, depending on the degree of engine power available, were it not for the decision to raise the flap handle to the retracted position, a decision contrary to engine-out emergency procedures. The Safety Board believes the loss of directional control began before the command to raise the flaps, but was aggravated by movement of the flap handle, which reduced system hydraulic pressure and rudder effectiveness. The decision to raise the flaps during the go-around was not only incorrect but contributed to the cause of the accident by rendering the airplane uncontrollable.

PROBABLE CAUSE

The Safety Board determined that probable cause of this accident was inadequate Southern Air Transport engine maintenance, which allowed the accumulation of oil residues in the engine compressor sections until two engines were incapable of responding to rapid demands for increased power. Contributing to the accident was the continuation of the go-around after power had been lost from two engines and movement of the flap handle to the flaps retracted position during the go-around.

APPLICATION TO MAC

There is always a time when we, as crewmembers, fall into habit patterns. The training environment tends to enforce a need for conditioned responses to achieve desired outcomes. A crew conditioned to raising flaps during a go-around with all engines operating can put themselves well behind the power curve when abnormal conditions arise and they rely on a conditioned response. Instructors—and students—must force themselves to be aware of the potential for disaster when conditioned responses are substituted for logical analysis and sound judgment.

Adapted from NTSB/AAR-88/03/SUM

C.R. TERROR

The Master Manipulator plays matchmaker.

As Lt. Blinky Donivan walked through the squadron door, he was sure he knew where his aircraft commander, the one and only C.R. Terror, Ace of Aerospace, could be found. Without delay, Blinky headed directly for the men's latrine. Sure enough, there was C.R., zipping up his flight suit, having just finished his morning "stand-up" appointment.

C.R. was never known to be at his best early in the day, and this morning certainly didn't appear to be an exception. In fact, as soon as The Prince of Pilots recognized Blinky and realized that a sympathetic ear was near, he started his litany of complaints.

"Blinky M'lad, I am a doomed man! My first cousin, Betty Lou

Terror, B.L.T. for short, is visiting for an unspecified period while she looks for a job. There just wasn't anything for her back home in Boonville, and she decided to try her luck here in the big city—maybe even get herself a government job, just like her favorite cousin C.R. did so many years ago. Well, she doesn't have a lot in the way of financial resources, so I'm more than happy to have her as a houseguest, but she feels obligated to help out.

"I'll be dead within the year if she keeps fixing me her famous 'country breakfast' every morning. The salt in the cured ham is driving my blood pressure up so high my head feels like a blood vessel or two must have sprung a leak. I'm even starting to see everything in a rosy shade of pink. Even worse, the eggs and butter are increasing my cholesterol count to the point that the old ticker is working harder than my sump pump did when the basement flooded last spring.

"Don't get me wrong, Blinky, she is an absolutely lovely young lady, and she most certainly is a great cook, but I'll end up looking like a nomex-covered, pot-belly stove again if I keep eating like this."

"Well Boss, it sounds to me like maybe you should take her to the Services Squadron and introduce her to their commander. I happen to know they've got an opening for a civilian cook in the flight kitchen. That place is currently known as the home of the original 'green cuisine.' She's bound to be a welcome addition to their staff."

"Gadzooks! Blinky, what a flash of inspiration. I take back all the navigator jokes I've told and promise not to tell another until at least tomorrow. Before the sun sets today, I'll get a hold of Lt. Col. Novy, another Whiz Wheel Wizard who had the pleasure of serving on my crew a time or two, and see what can be done. If we can get this girl gainfully employed or otherwise engaged, I may not have to resort to my ice cubes and jello diet."

By this time, C.R. had washed his hands and the pair made their way out of the latrine and were walking towards the "duty dog's" desk to find out what surprises the schedulers had in store. Our hero, who is not known as the Master Manipulator without reason, decided that with one avenue of relief in sight, it was time to start another. "Blinky, did I mention that B.L.T. is just about your age? She was Homecoming Queen her senior year and was voted 'Miss Hay Bale' at last year's county fair. Why don't you stop by tomorrow and help me change the oil in the Jag? You can say hello and maybe the two of you could take Windsock for a walk.

Blinky is not quite the Frustrated Follower of Femininity that his fearless leader has proven to be. Still, he has always liked C.R.'s dog, Windsock, and was curious to see what another apple from the Terror family tree looked like. Besides, his list of available dates was rather short. So, throwing caution and common sense to the wind, Blinky found himself agreeing to C.R.'s suggestion.

No sooner had they reached the front desk when a gasp escaped C.R.'s lips that had Blinky trying to remember the finer points from his CPR class.

"Blinky, look behind the desk, it's a virtual death warrant for mature fliers!"

Blinky looked past the Duty Officer, a young lieutenant who had already dialed the first three digits of the hospital's emergency room before he realized C.R. wasn't going to need immediate medical assistance, and found the following notice:

ALL PERSONNEL
BY DIRECTION OF COL. FANG, FRIDAY'S STAND-DOWN WILL INCLUDE A MANDATORY FITNESS CHECK USING THE 1 OCT 90 REVISED STANDARDS. NO ONE WILL BE EXCUSED. THOSE FAILING WILL BE ENTERED INTO THE BASE REMEDIAL FITNESS PROGRAM.

"Blinky, I saw the new numbers in last week's base paper. They expect those of us old enough to have lusted after Sky King's daughter, Penny, to lower our mile-and-a-half times by a full 50 seconds! I was sure the new standards would be delayed by an outcry from the medical community or maybe a reprieve from the Secretary of the Air Force. I just managed to pass last year—this may really be the end of my long and illustrious career."

"Now Boss, it's only Monday. Why don't we put in some extra effort this week and see if we can't get your times down? You're not nearly as heavy as you used to be, and you have been doing some exercise, haven't you?"

"Well I was, but with B.L.T. staying with me and all the TDYs we've been on, I may have let myself get a little out of shape. But you're right Blinky, the battle is not yet lost! We do have a few

"C.R. had adorned himself with no less than a thousand dollars worth of state-of-the-art athletic equipment."

days for some advanced conditioning. I'll get the schedulers to hold us down the rest of this week, and we'll dedicate ourselves to reconditioning the C.R. Terror Temple of Masculinity. Meet me at the gym in one hour."

Over an hour-and-a-half later, Blinky finally spotted the Great One's ancient baby-blue Jaguar pulling into the gym parking lot. Within seconds of parking in a spot reserved for someone other than himself, C.R. bounced out of his trusty steed, and a look of awe spread over Blinky's face. C.R. had adorned himself with no less than a thousand dollars worth of state-of-the-art athletic equipment. From his designer headband to his custom-made running shoes, nothing but the finest available products were on display.

"Blinky, with your able assistance and the help of modern technology, we will meet the challenge at hand. On my wrist

you see the receiving end of the most modern heart-rate monitor ever made. With this gadget, I get constant feedback on how hard the old pump is working. The monitor gives off an audible alarm whenever my heart rate exceeds the safe upper limit or drops below conditioning pace. Now, lets start out with a stretch or two and then see how close we can come to the new time limits."

Much to Blinky's amazement, C.R. could actually get within an inch or two of touching his toes. After a half dozen up and down strokes, beads of perspiration started to break out on C.R.'s expansive forehead, and his breathing had started to sound a lot like something you would expect to hear in the asthma ward. The toe touches were followed by a series of arm and leg stretches and, after a reasonable number of repetitions, the Sultan of Strain was ready to hit the track.

"All right Blinky, the new standard for my age group is 14 minutes and 40 seconds. Let's start out at a reasonable pace and try to save some energy for a Terrorific kick on the last lap." With that said, Blinky started out at what someone charitable could call a slow trot and C.R. put his ample poundage into motion. In just under three minutes, the pair had completed the first of six laps and C.R. was not showing any signs of immediate collapse. But, math major that he is, Blinky realized that holding this current pace would not allow them to finish within the prescribed time limit.

"Boss, we're going to have to pick up the pace. At the rate we're going, you'll miss your time limit by a couple minutes. Can you go any faster?"

"Certainly M'lad, merely warming up. Lead the way and I'll be right behind you." Blinky responded with a moderate increase in their pace and mixed expectations. Much to his delight, the Magic Major was able to keep up and their second lap was soon completed. One-third of the required distance now was covered, but unfortunately, a greater percentage of the allowable time was gone. Still, C.R. seemed to be holding up very well, so Blinky picked the pace up again and hoped for the best.

Two laps later, C.R. was still on Blinky's heels but definitely showing signs of strain. They had managed to get their time down to near the required pace, but were still behind on total time, and it was doubtful the next half mile could be completed in time.

C.R. was looking pretty pitiful—his lungs were burning hotter than the tips of the Egyptian gold-ringed Ovals he used to smoke, and his legs were quickly turning to lead. Still, the high tech monitor on C.R.'s wrist had not yet sounded the alarm, and while his breathing was certainly labored, he was still breathing.

As the pair rounded the corner just before the end of their fifth lap, Blinky saw something that almost stopped him dead in his tracks. Standing near the finish line was a vision of beauty that made Blinky's already racing heart beat even faster.

As C.R. neared the Goddess, she spoke with a voice as gentle as the wings of a butterfly. "Hurry Cousin C.R., I know you can do it!"

A look of determination came over C.R.'s face which showed the words had been taken to heart. C.R. not only picked up the pace, but actually passed a somewhat stunned Blinky who had not yet recovered from the shock of seeing B.L.T. for the first time.

With his masculine pride now at stake, C.R. reached deep inside for the last of his stored energy. This supply was quickly depleted, but by now his momentum was similar to that of a falling redwood tree, unstoppable, but sure to end with a crash.

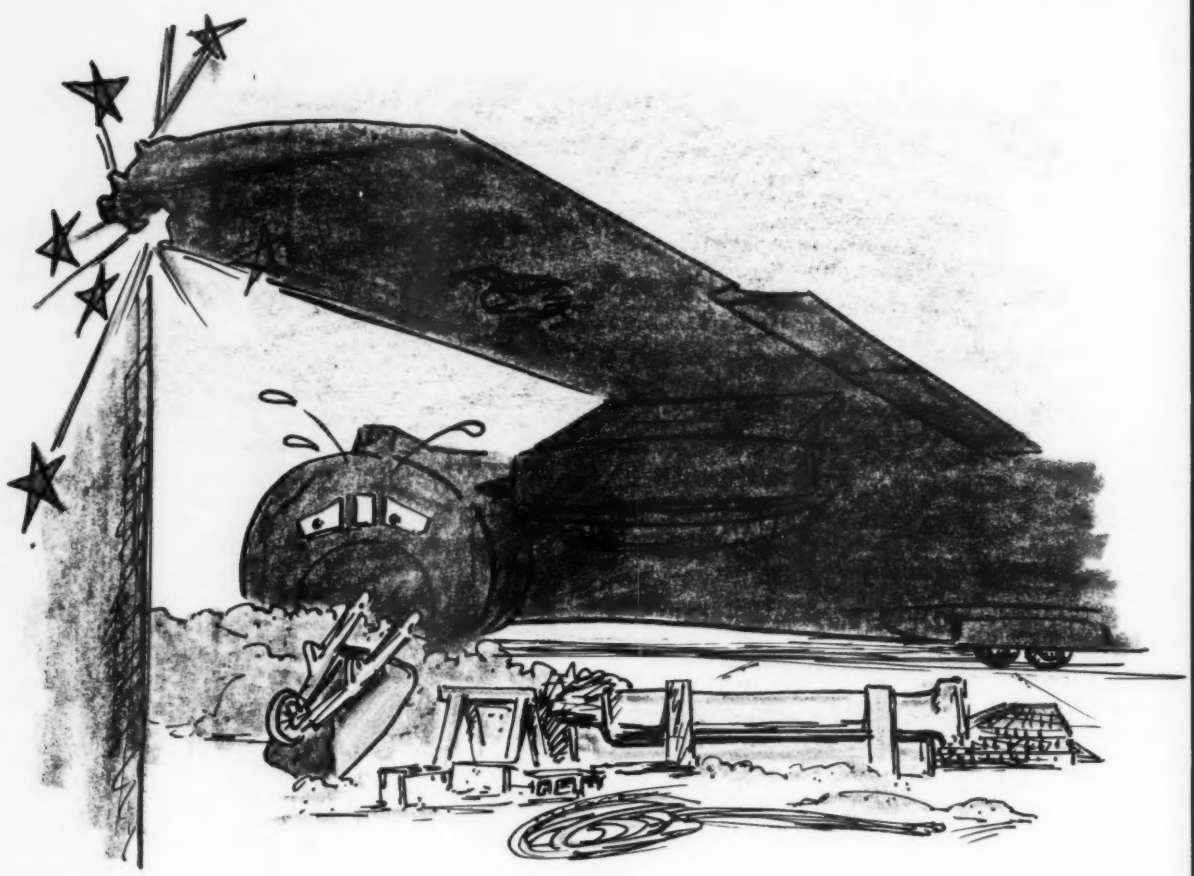
It took over half the final lap for Blinky to catch his boss. As he pulled alongside he could clearly hear the frantic beeping of the monitor on C.R.'s wrist. "Boss, listen to your alarm, maybe you better slow down."

C.R. had no breath to spare and could only shake his head in response. The finish line was rapidly approaching, with B.L.T. once again in view, and the Terrorific kick in full swing. Nothing short of an elephant gun could stop our thundering hero.

As C.R. passed the finish line, his monitor sounded one last alarm and then fused itself under stress of a terminal overload. C.R. looked dangerously close to meltdown himself, and he unceremoniously collapsed onto the soft grass along the edge of the track. Blinky, a veteran of many C.R. Terror, the Drop Zone Demon, run-ins and erratic escapes, remembered to stop his stopwatch. "Boss, Boss, are you all right? You made it! You finished with three seconds to spare! By the end of the week your time will be great! You really should try to keep a regular exercise schedule though, it sure would make things a lot easier on you."

After a few minutes had passed, and with a few gulps of water offered by the smiling B.L.T, C.R. regained enough breath to speak. "Blinky, how could you have any doubt—merely a warm-up run. I gotta' admit though, if I want a chance of passing next year, after they lower the time limit again, I'm going to have to be a little more consistent in my exercise efforts. By the way, have you met my cousin?"

QUICKSTOPPERS



Wing Tips Grow, Are You Listening?

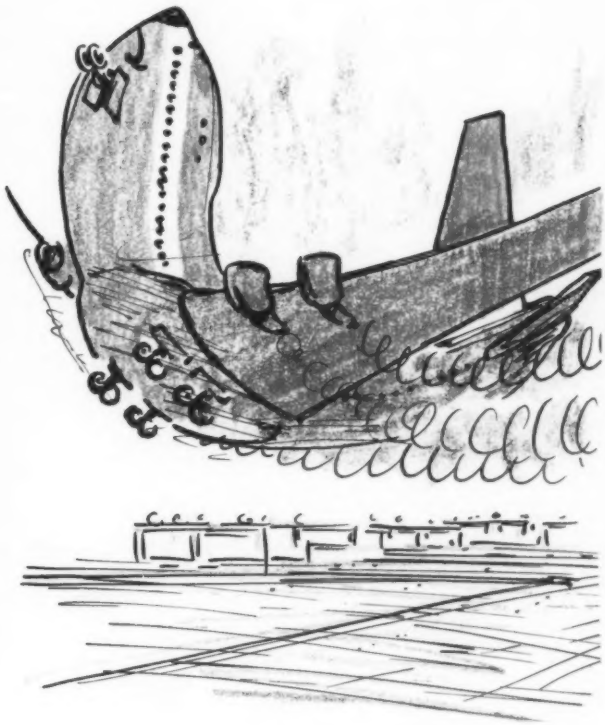
During a mission to equatorial Africa, a Starlifter crew encountered construction in progress near the military parking ramp. Along the edge of the ramp were the usual stacks of materials associated with building a new hangar, surrounded by a fence extending onto the ramp. After clearing the first obstacle safely, the pilot attempted to parallel the front of the hangar, guided by a long dirt pile and some indigenous personnel. Approaching the wall of the hangar, the pilot began a right turn into the parking spot. Both folks on the ground were giving a thumbs up sign which the crew took as meaning good clearance on the left wing tip. Then, to the amazement of the C-141 pilot, the head marshaller indicated the need for a left turn toward the hangar wall. The pilot began a right turn onto the parking spot and six to eight inches of the left wing tip struck the hangar wall. The pilot stopped the aircraft and the scanner inspected the damage to the wing tip and determined it was now safe to taxi to parking. Well, better late than never. A second look at the dirt pile revealed it wasn't parallel to the ramp edge or the hangar front, it guided them into the wall.

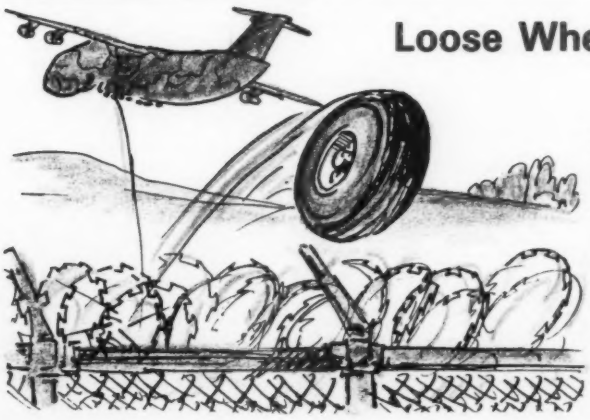
Approach Didn't Work—Neither Did "Salvage"

The copilot on a Boeing 747 was flying the aircraft inbound on a coupled approach. Suddenly, the flight mode annunciator go-around lights illuminated and the aircraft climbed above the glide path. The autopilot was disconnected and an attempt was made to regain the glide slope; however, a ground proximity warning sounded and a go-around was initiated. A second approach was made and a normal coupled landing accomplished.

Examination of the flight data recorder revealed both autopilots switched from "glide slope capture" to "go-around" mode when the aircraft height was 800 feet. This caused the aircraft to pitch up and fly above the glide slope. When the autopilots were disconnected and the aircraft flown manually, the resulting steep descent to regain the glide slope increased the rate of descent to 2,040 fpm. This triggered a genuine Mode 1 ground proximity warning at a height of 652 feet. Investigators attributed the cause of the go-around mode activation to inadvertent switch activation while the thrust levers were being advanced in response to decaying airspeed during the failed approach. The flight crew was counseled on the inadvisability of trying to salvage an unsuccessful coupled approach.

Courtesy: *Flight Safety Digest*





Loose Wheel Loser

During landing gear retraction, one of this Galaxy's wheels decided it wasn't going to continue the flight. After bouncing and rolling about a mile, the runaway wheel jumped a barbed-wire-topped chain link fence surrounding a munitions storage area. Having lost its energy the wheel stopped in its tracks. What brought on this desperate act by the wheel and tire isn't known for certain. We do know that, on occasion, folks have trouble getting the exact torque when installing C-5 wheels. Whenever the torque isn't just right, it seems the wheels like to take off on their own.

Flocks of Fun

Just as the Herk was in the landing flare, a flock of over 300 seagulls crossed the runway. Numerous birdstrikes were observed by the crew without impacting aircraft performance. After block-in, the flight engineer inspected all four engine intakes for possible bird ingestion. We don't know if he used a ladder to check the intakes, but no damage was noted. The crew did find birdstrikes on all leading edge surfaces, flaps, and landing gear. Prior to takeoff for home station, the crew performed a maximum power engine check and all indications were normal. Home station maintenance found bird parts lodged on the engine inlet guide vanes of Number 2 engine and some bird parts in Number 4 engine. Guess that first inspection wasn't as thorough as the flight crew thought it was.

AFTER DEADLINES

IT IS WITH DEEP REGRET - That we acknowledge the loss of two valuable MAC assets. The first to occur was the loss of a Kelly reserve crew aboard a Travis C-5. The second was the individual loss of a true stalwart in the safety field, Lt. Col. Dave Adams, former Chief of Safety of the 118 TAW, Nashville, Tenn. Colonel Adams' unexpected loss will be felt not only by his home unit but by the entire MAC family. Godspeed to all.

OPERATION DESERT SHIELD - Since the beginning of the operation, MAC has directed more than 1,900 airlift missions (including CRAF aircraft), hauled more than 87 million pounds of cargo and transported more than 60,000 people. This is the equivalenst of a city the size of Norman, Okla., including not only the people but their cars, trucks, food, stock, and household goods. This was accomplished with an average of 75 daily sorties to the theater and from 100 to 110 additional sorties in theater. The airlink to the Mideast was established by MAC C-141 and C-5 strategic airlifters manned by active-duty, guard, and reserve crews.

TICKET REFUNDS - Several major airlines are offering waivers to nonrefundable ticket holders scheduled for military leave who are unable to meet travel plans because of the Middle East situation. The assistance is also geared towards families of these service men and women. Many service members could lose money because they hold nonrefundable tickets for leave travel and face leave cancellation by their unit as a result of Operation Desert Shield. Proposed solutions offered by the airlines range from full refunds to waiving penalties for cancellation or reticketing. Some airlines are honoring tickets for later travel on the same itinerary for up to a year. Airline policy for penalty waivers and reticketing may vary. More information and guidance is available from airlines and commercial ticket offices.

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The C-46 Curtis Commando, known as "Ol' Dumbo," was the star of the India-China airlift and will always be remembered as the plane that flew the Hump.